Unit 4: Linear Relationships

Content Area: **Mathematics**
Course(s): **Mathematics**
Time Period: **Week 15**
Length: **5 weeks**
Status: **Published**

Unit Overview

Students will begin this unit by reviewing the concept of proportional relationships. They will be able to identify them by their representations in tables, graphs, and equations. Then, students will learn about slope/rate of change. They will be able to calculate slope when given a graph, two points, or a table. Next, students will be able to identify the x and y-intercepts of an equation both algebraically and visually. They will then apply the concepts of slope and y-intercept and discover the properties of an equation written in slope-intercept form. Students will learn how to take an equation written in standard form, convert it into slope-intercept form, and identify its slope and y-intercept. This topic will lead students into graphing linear equations. They will be able to graph equations written in slope-intercept and standard forms. Finally, students will be able to compare multiple linear relationships and will be able to identify which one has a greater rate of change and which has a greater initial value.

Standards

MA.8.EE.B.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.
MA.8.EE.B.6	Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.
MA.8.F.A.2	Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.8.F.A.3	Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

Essential Questions

- How can one recognize linear relationships?
- How can seeing the graph of a linear relationship be used to describe and explain real-world situations?
- How are patterns of change related to the behavior of functions?

Application of Knowledge: Students will know that...

- a linear equation will produce a straight line when graphed.

- a proportional relationship is when two quantities vary directly with one another. It has a constant rate of change and is represented by a straight line through the origin. The equation for a proportional relationship is of the form y = mx.
- for y = mx + b, "m" stands for slope and "b" stands for the y-intercept of the equation.
- slope (or rate of change) is constant for a linear relationship.
- slope is calculated by either using "rise/run" or "y2 - y1 / x2 - x1".
- slope-intercept form is y = mx + b.
- to find the x-intercept, plug in zero for "y" and solve for "x".
- to find the y-intercept, plug in zero for "x" and solve for "y".
- to graph a linear equation in slope-intercept form, one should always "begin" at the y-intercept and "move" in the direction that the slope indicates.

Application of Skills: Students will be able to...

- calculate the slope of a line when given either a graph, two points, or a table.
- calculate the x and y-intercepts of a linear function.
- compare multiple linear relationships by identifying which has a greater rate and which has a greater initial value.
- create a word problem that has a proportional relationship and will be able to construct a table, graph, and equation to represent it.
- graph linear equations by utilizing the properties of the slope-intercept form of the equations.
- graph linear equations by utilizing the x and y-intercepts.
- identify proportional relationships when given a table, graph, or equation.
- identify the slope and y-intercept of an equation.
- transform an equation into slope-intercept form.

Assessments

- Do-Nows: These daily assessments will be used to check for prior knowledge and to determine mastery of particular topics. If needed, remediation will be completed on an as needed basis.
- Communicator practice: This will be used as a quick whole-class assessment tool to check for complete comprehension.
- Exit Tickets: These will be used to measure student understanding of the lesson and assist in determining whether remediation is needed for the topic.
- Proportional Relationships Posters: An activity that can be used as a summative assessment (see description in activity section).
- Slope Drawing Activity: An activity that can be used as a formative assessment (see description in activity section).
- Gallery Walk/Scavenger Hunt: An activity that can be used as a formative assessment (see description in activity section).
- Stained Glass Window: An activity that can be used as a formative assessment (see description in activity section).
- Practice using IXL
- Mid-Unit Quiz
- Unit Test

- Information from this unit will be included on a locally developed, mid-year or end of year benchmark assessment that may take the form of a test, performance based project, or other summative assessment.

Suggested Activities

- Grade 8 Digits Topic 5 Launches
- Student-centered SMART Board lessons: including interactive coordinate graphs for graphing linear equations and visual models for slope
- Review games using Communicators
- Proportional Relationship Posters: Students will create a word problem that represents a proportional relationship (i.e. "Suzy's iced tea mix needs 1 scoop of mix for every 2 cups of water"). They will need to construct a table, graph, equation, and question that they will solve based on the problem. They will display their work on a small piece of poster paper.
- Slope Drawing Activity: This is a teacher-generated activity in which students create a picture of their own utilizing straight lines. They must then go back and find the slope of all the lines that make their picture. As a challenge, have students go back and utilize the formula for finding the slope when given two points.
- $y = mx + b$ Investigation: Students will be given three equations in slope-intercept. They will be given a table to complete and a coordinate graph to plot the points from the table. Then they identify the slope, x-intercept, and y-intercept of the graph and will need to identify which of the properties have a relationship with the parts of the slope-intercept form of linear equations.
- Gallery Walk/Scavenger Hunt: Students will complete problems posted around the room on the topic of slope . The answer to each poster will lead students to the next poster. This will create a sequence that students will complete in a specific order.
- Stained Glass Window: Students will choose a specified number of linear equations for a provided list, including special cases of vertical and horizontal lines. Then they will graph the lines on a coordinate plane and color each resulting section so that it resembles a stained glass window.
- Styrofoam Cup Activity: Students will work in small groups and be given 5 styrofoam cups. They will be asked how tall a 60 cup stack would be, how many cups are needed to make a 200 cm tall stack, and how many cups would be needed to to create a stack that is the height of the teacher. This will lead to writing a linear equation.

Activities to Differentiate Instruction

Differentiation for special education:

- General modifications may include:
    - Modifications & accommodations as listed in the student's IEP
    - Assign a peer to help keep student on task
    - Modified or reduced assignments
    - Reduce length of assignment for different mode of delivery
    - Increase one-to-one time

    - Working contract between you and student at risk
    - Prioritize tasks
    - Think in concrete terms and provide hands-on-tasks
    - Position student near helping peer or have quick access to teacher
    - Anticipate where needs will be
    - Break tests down in smaller increments

- Content specific modifications may include:
    - Provide personal handout for integer rules
    - Provide personal handout with formulas for slope and slope-intercept form
    - Provide different colored pencils that will be used to show the rise and the run on a graph. Associate the rise with a particular color and the run with another color.
    - Provide coordinate planes in which the x and y-axis go from -5 to 5 rather than -10 to 10 for transformations
    - Provide completed problems for practice work and homework

Differentiation for ELL's:

- General modifications may include:
    - Strategy groups
    - Teacher conferences
    - Graphic organizers
    - Modification plan
    - Collaboration with ELL Teacher

- Content specific vocabulary important for ELL students to understand include: linear, proportional relationship, unit rate, vertical, horizontal, intercept, steeper, initial value, coordinate plane/graph

Differentiation to extend learning for gifted students may include:

- Provide students with a given slope and two coordinate points in which either one x-coordinate or y-coordinate is missing. Students will need to solve for the missing coordinate.
- Provide students equations in standard form that have rational coefficients for finding x and y-intercepts and also for graphing.
- Discuss how to graph linear inequalities

Technology Integration

- iPads or Chromebooks as appropriate to the activity.
- Online learning components including use of the Digits digital textbook and resources.
- Teacher integration of the SMART board to facilitate active student engagement throughout the course of the lesson.
- Software or online programs that teachers may use to create students materials or generate problems such as Kuta software.

- Additional practice provided through the use of IXL.

Integrated/Cross-Disciplinary Instruction

- **ELA:** Practice formulating complete and grammatically correct responses to open-ended questions.
- **Science:** Model linear equations that relate to science topics, such as the growth of a pine tree. Students can solve to find how many years it will take to reach a certain height and how tall it would be after a given number of years.
- **Economics:** Model linear equations that relate to businesses in which the y-intercept is the initial cost and the slope is the unit rate for the product. Students can identify the initial cost and unit rate of the product and then use this information in order to find when the business will break even and when they will earn a specified amount of profit.

Resources

- Digits student access and support: www.MyMathUniverse.com
- Digits teacher materials and support: www.pearsonrealize.com
- IXL: www.ixl.com
- SMART Exchange: http://exchange.smarttech.com/index.html#tab=0
- SMART Board lessons
- Coordinate graph worksheets
- Slope drawing activity worksheet
- Punchline/Pizzazz worksheets (self-correcting)
- Kuta software generated worksheets

21st Century Skills

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.